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Risk Factors Affecting the Occurrence of Acute Otitis Media among 2–3-Year-Old Urban Children

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The factors affecting the occurrence and recurrence of acute otitis media (AOM) were studied among 471 2–3-year-old children in two cities in Finland. Of these children, 188 had experienced ≥3 attacks of AOM, 76 had had 1–2 attacks and 207 no otitis attacks (= control group). The study showed that the risk of recurrent AOM was increased among those children attending day-care nurseries as well as among those who had several siblings. Proneness to rhinorrhea and exposure to passive smoking at home was associated with an increased risk of AOM, while prolonged breast-feeding (>6 months) seemed to reduce it. No correlation was found between the risk of recurrent AOM and the place of residence or type of housing, the parental otitis history, or atopic diathesis of a child. The study suggested that to protect a young child from AOM we should promote breast-feeding and home-care for babies as well as avoid smoking in the home. *Key words: middle ear, epidemiology, environmental factors.*

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Acute otitis media (AOM) is a very common affection among young children. Typical of the disease is a high incidence of recurrences, especially during the first few years of life (1, 2, 3). One reason for this is that the immunological defence mechanisms of a child mature relatively slowly during the first years of life (4) leaving a young child prone to infections. But environmental factors such as population density (5) and air pollution (6) have also been shown to affect the occurrence of AOM considerably.

The purpose of this study was to evaluate factors predisposing to recurrent AOM in a population of 2–3-year-old urban children in Finland.

MATERIAL AND METHODS

The patient material of the present study consisted of 264 consecutive 2–3-year-old children who visited, because of AOM (characterized by acute symptoms and effusion in the middle ear) the Out-Patient Department of Otolaryngology or Pediatrics of the University Central Hospitals of the cities of Tampere and Oulu in Finland. There were 120 girls and 144 boys. As a non-otitis control-group we took 207 children (106 girls, 101 boys) of the same age from the municipal children's health centres of the same two cities. The enrolment criterion was freedom from AOM thus far in life. The mean age of the otitis patients was 2.90 years and that of non-otitis controls, 3.09 years.

During the Out-Patient AOM visit, information regarding the number of attacks of AOM experienced thus far during the child's lifetime as well as epidemiologic data of interest for the study was obtained by means of a questionnaire to the parents of the otitic children. A

similar questionnaire was filled in by parents of non-otitic children in the children's health centres. The questionnaire comprised the following questions: The duration of breast-feeding, the day-case arrangements, the number of siblings and their otitis history, presence of allergic manifestations, occurrence of rhinorrhea and other respiratory infections, the otitis history and smoking habits of the parents and the family's place of residence.

To study the factors associated with AOM, the children were classified into three groups according to the otitis history (the questionnaire-visit included): no attacks (= control group, $n=207$) 1 or 2 attack(s) ($n=76$) and three or more attacks ($n=188$). For statistical analysis we used the χ^2-test.

RESULTS

Of all children, 91 had been cared for in day-care centres for more than a 6-month period (Table I). They were found to have had AOM significantly more often than children cared for at home, whereas day-care within the family did not increase the number of otitis attacks. Also, on the other hand, the number of siblings in a child's family affected the frequency of AOM almost significantly, so that greatest risk of repeated attacks was found among those children who were from families with three or more children (Table II).

In the present study neither the place of residence (within the city limits) nor the type of housing affected the risk of contracting AOM. Likewise, no correlation was found between the parental otitis history and the occurrence of AOM in the children.

Breast-feeding—and especially its prolongation for over 6 months—seemed to protect a baby against AOM, and a significant negative correlation was found between the duration of breast-feeding and the number of otitis attacks (Table III).

In 207 families the parent(s) smoked and this was found significantly to sensitize a child to AOM compared with children from non-smoking families (Table IV).

Furthermore, a highly significant correlation was found between the occurrence of rhinorrhea (as compared with its frequency in other children in the neighbourhood) and a liability to repeated otitis attacks (Table V).

Table 1. *Day-care arrangements and occurrence of AOM*

Number of attacks	Day-care form[a]		
	Day-care[b] centre	Family[b] day-care (home)	Own home
0	28	41	133
1–2	16	15	45
≥3	47	35	102
Total	91	91	280

Significance of partitioned columns	χ^2	DF	p
Day-care centre vs. own home	8.486	2	0.014
Day-care centre vs. family care	4.237	2	0.120
Family care vs. own home	0.171	2	0.918

[a] Data not available from 9 children.
[b] Cared for ≥6 months outside own home.

16.6% of all the children showed some atopic manifestation; infantile eczema was found in 11.8%, asthma in 2.3% and hay-fever in 2.5%. No significant correlation was found between the allergic diathesis and the occurrence of AOM.

DISCUSSION

Because of the commonness of AOM (7) and the magnitude of human suffering and economic loss it causes, every effort must be made to reduce its frequency. Therefore epidemiological studies of the factors affecting the occurrence of (recurrent) AOM and the possible removal of these factors are of importance.

In the majority of cases, AOM is nowadays preceded by an upper respiratory viral infection (8, 9, 10, 11). One of the most outstanding manifestations of respiratory infection is rhinorrhea. In the present study, a close correlation was found between a proneness to rhinorrhea and the recurrence of otitis attacks. Although we did not distinguish between allergic and viral rhinorrhea, the finding might suggest that the mucosa of one part of the respiratory tract—the middle ear—reflects the changes of another part—the nose—regardless of the background of the damage.

Viruses tend to spread more easily, the higher the population density in a certain area. Thus the number of human contacts in a child's daily life plays a very important part in the

Table II. *Size of the family and occurrence of AOM*

Number of attacks	Number of siblings		
	0	1	≥2
0	97	80	30
1–2	30	35	11
≥3	64	77	47
Total	191	192	88

Significance of partitioned colums	χ^2	DF	p
0 vs. ≥2	11.449	4	0.022

Table III. *Breast-feeding and occurrence of AOM*

Number of attacks	Duration of breast-feeding (months)			
	<1	1–3	4–6	>6
0	16	89	43	59
1–2	11	32	15	18
≥3	36	73	41	38
Total	63	194	99	115

Significance of partitioned colums	χ^2	DF	p
<1 vs. 1–3	9.178	2	0.010
<1 vs. 4–6	5.571	2	0.062
<1 vs. >6	12.252	2	0.002

likelihood of contracting AOM. Day-care centres with many children in the same place create favourable conditions for respiratory epidemics (12), with AOM as a sequel. This is confirmed in our study by the children who attended day-care centres and who contracted AOM more frequently than children cared for in their own homes, a finding also consistent with some earlier reports (13, 14, 15, 16). The greater size of the family increases the number of daily human contacts of a child and may work analogously with the day-care. Accordingly, in the present study, the children from families with three or more children contracted AOM more frequently than children from smaller families. Cunningham (17) also stated that the presence of other children was associated with increased morbidity in respiratory infections, otitis media included. On the other hand, Watkins et al. (18) and Vinther et al. (19) did not find any correlation between the number of siblings and the frequency of AOM, and in the series of Paterson & MacLean (20) the non-otitis control children even belonged to larger families compared with children with AOM. Consequently, although the reports on the effect of family size on the liability of a child to contract AOM are not all in agreement, we strongly recommend that children should be cared for in small, separate, family-size groups (12) instead of large day-care centres.

Prolonged breast-feeding has been found to protect a baby against respiratory infections in general (18, 21). This is thought to be due to the transmission of specific human immunoglobulins in breast milk thus improving the immunological defence mechanisms of an infant (22, 23, 24). Furthermore, the immunoglobulins may also coat the bowel mucosa, thus preventing the absorption of harmful cow's milk proteins (25). In the present study,

Table IV. *Exposure to passive smoking and occurrence of AOM*

Number of attacks	Smoking of parents(s)	
	No	Yes
0	136	71
1–2	40	36
≥3	93	95
Total	269	202

Table V. *Rhinorrhea and occurrence of AOM*

Number of attacks	Occurrence of rhinorrhea compared with other children in neighbourhood*				
	Never	Less than in other children	Equally with other children	More than in other children	Contin-uously
0	18	75	112	2	0
1–2	3	13	53	6	0
≥3	0	9	128	37	10
Total	21	97	293	45	10

Significance of the whole contingency table	χ^2	DF	p
	119.99	8	<0.001

* Data not available from 5 children.

children who had been breast-fed for over 6 months experienced significantly fewer episodes compared with those breast-fed for less than 1 month. This is in accordance with reports indicating a lower recurrence rate of AOM among infants breast-fed over a relatively long period, i.e. 6–12 months (25, 26), and with the finding that infants breast-fed for less than 3 months experienced their first AOM significantly earlier than those breast-fed for longer periods (27). On the other hand, no significant correlation between the duration of breast-feeding and the liability to contract AOM was found by Kjellman (28) and Vinther et al. (19), probably because of the design of these studies. However, evidence strongly supports the advisability of breast-feeding, which in fact is becoming more fashionable again after a period of underrating this natural way of nourishment (18, 29, 30). This favourable development should be encouraged.

Parenteral smoking exposes the whole family to smoke and this "passive smoking" has been found to predispose children to respiratory infections (6, 31, 32, 33). Accordingly smoke must be a predisposing factor to AOM, too. However, as far as we know there are no earlier reports indicating an increased risk of AOM among children from smoking families. On the contrary, Vinther et al. (19) did not find any such connection, probably because of the masking effect of other parameters (e.g. day-care) in their study. The problem of passive smoking has become more important along with changes in housing, with increasingly more families living in cities in rather small flats, where the amount of indoor smoke reaches much higher concentrations, compared with old-fashioned farm-houses.

Opinions of the role of allergy in the etiology of AOM are not unanimous. In the present study no constant correlation was found between atopic diathesis of a child and the frequency of AOM, an observation also made by Kjellman (28). Many studies, however, have shown an association between atopic allergy and a tendency to recurrent or prolonged otitis, i.e. secretory otitis media (25, 34, 35), especially among children who also had a positive family history of allergy (36). On the whole, the role of allergy *per se* as a risk factor to AOM might not be to straightforward after all, and further studies are warranted to clarify this.

In conclusion, our study revealed that certain factors associated with the proness of small children to acute and recurrent otitis media can be regarded as a consequence of social and cultural changes. When trying to reduce the frequency of AOM in children these factors must be taken into account, e.g. the involvement of parents in the promotion of home-care for small children and the avoidance of smoking at home.

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